

Tungsten

CAS No. 7440-33-7

General Information

Tungsten is a steel-gray to tin-white metal naturally occurring in the earth's crust, mainly as scheelite (CaWO_4). A major use of tungsten is in the production of hard metals, such as tungsten carbide, used in rock drills and metal-cutting tools, or ferrotungsten, used in the steel industry. Additionally, tungsten compounds are used as catalysts in the petroleum industry, lubricating agents, filaments for incandescent lamps, and bronzes in pigments.

Most background environmental exposures to tungsten are from the soluble forms, such as tungstate salts, whereas occupational exposure is from tungsten metal dusts released during the grinding or drilling of metals. Workplace air standards for external exposure are generally established (ACGIH) or recommended (NIOSH). Evidence for the carcinogenicity of tungsten is inadequate or unknown (IARC, NTP).

Interpreting Urine Tungsten Levels Reported in the Tables

Urine tungsten levels were measured in a subsample of NHANES participants aged 6 years and older. Subsamples were randomly selected within the specified age

Table 29. Tungsten

Geometric mean and selected percentiles of urine concentrations (in $\mu\text{g/L}$) for the U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 1999-2000.

	Geometric mean (95% conf. interval)	Selected percentiles (95% confidence interval)						Sample size
		10th	25th	50th	75th	90th	95th	
Total, age 6 and older	.081 (.074-.088)	< LOD	< LOD	.070 (.070-.080)	.180 (.150-.200)	.310 (.270-.360)	.480 (.410-.550)	2465
Age group								
6-11 years	.145 (.117-.181)	< LOD	< LOD	.150 (.120-.190)	.270 (.210-.330)	.510 (.360-.590)	.590 (.460-.830)	340
12-19 years	.099 (.085-.115)	< LOD	< LOD	.110 (.080-.120)	.200 (.170-.240)	.340 (.280-.420)	.500 (.390-.580)	719
20 years and older	.072 (.066-.079)	< LOD	< LOD	.060 (.060-.070)	.150 (.120-.170)	.280 (.250-.320)	.440 (.320-.520)	1406
Gender								
Males	.094 (.082-.107)	< LOD	< LOD	.100 (.080-.110)	.210 (.170-.240)	.380 (.280-.460)	.510 (.420-.720)	1227
Females	.070 (.065-.076)	< LOD	< LOD	.070 (.060-.070)	.140 (.120-.160)	.260 (.240-.290)	.370 (.320-.460)	1238
Race/ethnicity								
Mexican Americans	.087 (.072-.106)	< LOD	< LOD	.080 (.070-.100)	.170 (.150-.220)	.350 (.280-.440)	.520 (.400-.690)	884
Non-Hispanic blacks	.104 (.090-.121)	< LOD	< LOD	.090 (.080-.110)	.200 (.170-.240)	.340 (.280-.460)	.560 (.400-.810)	568
Non-Hispanic whites	.080 (.072-.089)	< LOD	< LOD	.070 (.060-.080)	.180 (.150-.200)	.310 (.260-.370)	.470 (.380-.520)	822

< LOD means less than the limit of detection, which is 0.03 $\mu\text{g/L}$.

range to be a representative sample of the U.S. population. Measuring tungsten at these levels in urine is possible because of advances in analytical chemistry. Finding a measurable amount of tungsten in urine does not mean that the level of tungsten causes an adverse health effect. A non-random subsample from NHANES III found higher values than those reported in Table 29 (Paschal et al., 1998), possibly due to methodologic differences. One small study of unexposed individuals (n = 14) yielded values similar to those reported here (Schramel et al., 1997). During grinding operations that release tungsten metal into the air, workers had elevated urinary tungsten levels that were more than 900 times higher than the overall geometric mean in the NHANES 1999-2000 subsample (Kraus et al., 2001). In addition,

these urinary levels in workers did not correlate with air-exposure levels. Kraus et al. (2001) also indicated a reference value for unexposed populations of 1 µg/gram creatinine (or 0.86 µg/L) as the 95th percentile. The application of the technique of neutron activation analysis to a control group of non-metal workers showed mean urine tungsten levels similar to levels at the 95th percentile of the NHANES 1999-2000 subsample, whereas the tungsten-worker group had mean urine levels 35 times higher (Nicolaou et al., 1987). The variation of urinary tungsten levels across this NHANES subsample was narrow, possibly indicating limited opportunities for exposure. Geometric mean levels of the demographic groups were compared after adjustment for the covariates of race/ethnicity, age, gender, and urinary

Table 30. Tungsten (creatinine adjusted)

Geometric mean and selected percentiles of urine concentrations (in µg/gram of creatinine) for the U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 1999-2000.

	Geometric mean (95% conf. interval)	Selected percentiles (95% confidence interval)						Sample size
		10th	25th	50th	75th	90th	95th	
Total, age 6 and older	.076 (.070-.083)	< LOD	< LOD	.074 (.068-.079)	.134 (.119-.150)	.240 (.200-.293)	.381 (.313-.426)	2465
Age group								
6-11 years	.159 (.138-.183)	< LOD	< LOD	.165 (.135-.198)	.274 (.216-.326)	.439 (.326-.667)	.667 (.452-.880)	340
12-19 years	.075 (.067-.083)	< LOD	< LOD	.075 (.067-.083)	.133 (.114-.151)	.225 (.175-.262)	.326 (.232-.436)	719
20 years and older	.069 (.063-.076)	< LOD	< LOD	.068 (.061-.074)	.117 (.104-.133)	.200 (.169-.268)	.333 (.240-.418)	1406
Gender								
Males	.073 (.065-.082)	< LOD	< LOD	.068 (.060-.077)	.136 (.117-.161)	.268 (.198-.380)	.426 (.322-.573)	1227
Females	.079 (.073-.085)	< LOD	< LOD	.077 (.071-.083)	.130 (.116-.145)	.231 (.200-.271)	.333 (.275-.376)	1238
Race/ethnicity								
Mexican Americans	.080 (.066-.098)	< LOD	< LOD	.082 (.068-.101)	.164 (.132-.188)	.300 (.226-.375)	.431 (.340-.600)	884
Non-Hispanic blacks	.068 (.060-.076)	< LOD	< LOD	.068 (.060-.079)	.121 (.109-.143)	.201 (.185-.231)	.342 (.217-.459)	568
Non-Hispanic whites	.080 (.073-.089)	< LOD	< LOD	.076 (.069-.084)	.138 (.118-.165)	.268 (.200-.333)	.381 (.308-.426)	822

< LOD means less than the limit of detection (see previous table for LOD).

creatinine. Urinary tungsten levels were higher for the 6-11-year-old group than for the other two age groups. Levels in Mexican Americans were higher than in non-Hispanic blacks. It is unknown whether differences between ages or races/ethnicities represent differences in exposure, body-size relationships, or metabolism.

Whether tungsten at the levels reported here is a cause for health concern is not yet known; more research is needed. These urine tungsten data provide physicians with a reference range so that they can determine whether people have been exposed to higher levels of tungsten than levels found in the general population. These data will also help scientists plan and conduct research about tungsten exposure and health effects.

